Memorandum

July 30, 2020

To: Kira Lynch, Ravi Sanga, and Richard Mednick, U.S. Environmental Protection Agency

From: East Waterway Group

Re: East Waterway Technical Clarifications from July 10, 2020 Meeting

The U.S. Environmental Protection Agency (EPA) and East Waterway Group (EWG) met on July 10, 2020, for the stated purpose of identifying common ground in order to move toward a timely implementation of the remediation of East Waterway (EW) sediments. To that end, this memorandum addresses technical misconceptions that were communicated during the meeting in order to maintain a common technical understanding of the EW site. The EPA-approved EW Feasibility Study (FS) presents thorough and detailed analyses of the EW site and evaluation of important factors that affect the anticipated post-construction and long-term sediment concentrations that are expected to be achieved. The topics addressed in this memorandum refer to relevant parts of the FS that relate to the physical conceptual site model, the feasibility of conducting cleanup, and the expected long term performance of cleanup alternatives over time, each of which is directly relevant to setting attainable cleanup levels.

This memorandum addresses the following topics:

- Underpier remediation by in situ treatment
- Rock keyways and structural setback areas
- Natural recovery timeframes
- Sediment inputs to the EW
- Use of FS modeling to support anthropogenic background

Underpier Remediation by In Situ Treatment

In the July 10, 2020 meeting, EPA stated that it has a differing opinion on the impact of underpier sediments on the long-term average concentrations that can be achieved at the EW site and seemed to suggest that the EW site will achieve concentrations that are lower than what has been modeled in the FS. However, in stating that opinion, EPA repeatedly mischaracterized the underpier remedial technology as an "amended cap" rather than as "in situ treatment." This is important because caps are engineered to isolate contaminated sediments through use of multiple layers, including an armor layer to protect from the significant propwash present in the EW, requiring the cap to be several feet thick. The FS found that engineered caps are infeasible in the underpier areas due to equipment inaccessibility, structural and slope impacts from placing added weight, and steep underpier slopes that range from 1.75 horizontal to 1 vertical (1.75H:1V) and 2H:1V (FS Section 7.2.5.2). The in situ treatment planned for underpier areas is a feasible remedial technology that is expected to support substantial risk reduction, but it is expected to be a few inches thick and composed of a product like

AquaGate+PAC™ or Sedimite™. Additionally, due to propwash, the underpier sediments and the in situ treatment material are expected to mix and be redistributed into the open water portions of the EW.

EWG is concerned that EPA is not considering the important difference between amended capping and the in situ treatment technologies that are feasible in EW underpier areas. As directed by EPA and its technical experts from the U.S. Army Corps of Engineers (USACE) for the FS, the base case modeling assumptions are considered to be the most technically defensible and most probable estimate of in situ treatment performance following remediation. Based on the substantial empirical dataset reported in the Supplemental Remedial Investigation (SRI) and FS, the full volume of underpier sediment (estimated to be 2 feet thick on average) and placed in situ treatment material is expected to regularly mix as a result of propwash (FS Section 5.3.3). In addition, FS modeling assumed that 25% of the underpier sediment and in situ treatment material will be resuspended and redistributed into the open water area every 5 years (and an equal volume of open water sediment will move into the underpier area [FS Section 5.3.4]). This mixing and exchange of underpier sediment will result in dilution of the activated carbon, which is why the FS assumed lower bioavailability reduction (70%) than what is typically reported in literature (FS Section 5.3.5). It is essential that EPA understands that the FS concluded that in situ treatment material placed underpier is expected to mix and not behave as an engineered amended cap due to the ongoing sediment mixing from propwash occurring in the EW open water and underpier areas.

Rock Keyways and Structural Setback Areas

EWG would like to emphasize the importance of the rock keyways or structural setback areas on site-wide performance. As part of the FS, Appendix A reviewed the most important factors that affect the technical possibility of achieving site-wide cleanup levels. FS Appendix A reviewed each of the important remedial technologies to be employed with the alternatives to estimate the lowest achievable concentration that could be achieved in the EW immediately following construction. Six areas of the EW were evaluated, including the 15 acres of underpier sediments (Area 2), but two other very important areas were evaluated as follows:

- **Area 3 – Rock Keyways.** Seven acres of rock keyways are present at the base of the underpier slopes. These rock structures are keyed into the toe of the slopes to maintain the stability of the slopes above. The tops of the keyways are situated at the navigation depth of approximately -51 feet mean lower low water, therefore limiting the amount of removal and the amount of clean material placement that can be performed in these areas (e.g., engineered cap, enhanced natural recovery, residuals management layer). For the FS Appendix A analysis, these areas were assumed to be dredged to the maximum extent possible without removing riprap, followed by thin placement of in situ treatment material to reduce bioavailability. However, FS Appendix A describes that some keyway areas are already at the required navigation elevation and placement would not be possible due to navigation requirements.

- **Area 4 – Structural Setbacks.** Eighteen acres of structural slope and offset areas will have dredge depths limited by the geotechnical stability of adjacent slopes. In these areas, some contaminated sediment will be left behind; however, these elevation constraints are assumed to still allow the placement of a full residuals management cover layer, but not an engineered cap.

Each of these areas will contain contaminated sediments that will be present after completion of cleanup (within rock interstices in Area 3 and adjacent to the keyways in Area 4) and be subject to mixing from propwash, with some of that material resuspended and settling in the EW. This contaminated sediment that will continue to remain in the system cannot be ignored when considering what concentrations can be attained in the EW in the short and long term.

Natural Recovery Time Frames

EPA said during the July 10, 2020, meeting that FS Appendix J states that the EW site will equilibrate to an area-wide anthropogenic background concentration. EPA also described the Green River as the input for determining anthropogenic background during the July 10, 2020 meeting. The FS states that incoming sediment concentrations from the Green River are the primary controlling factor in determining the concentration to which the EW site will equilibrate, but other factors also influenced long tern concentrations, including inputs from the Lower Duwamish Waterway (LDW; lateral inputs and bed sediment), net sedimentation rate, vertical mixing depth, mixing area, exchange of underpier sediment with open-water areas, bioavailability of in situ treatment in underpier areas, dredge residuals thickness and concentration, and EW lateral input solids and chemistry. The FS modeling directed by EPA and its technical experts does not demonstrate that surface sediment concentrations for polychlorinated biphenyls (PCBs) in the EW will ever be equivalent to incoming Green River sediment concentrations. Based on site characteristics and modeling results, it is clear that PCB concentrations even approaching those of incoming Green River sediments will not be attained. In the base case modeling scenario in FS Appendix J Table 6, Alternative 2B SWAC is predicted to be 42 micrograms per kilogram (µg/kg) for total PCBs immediately following construction (adjusted for in situ treatment porewater reductions) but increases to 72 µg/kg following mixing and slowly declines to 57 µg/kg after 40 years, compared to an incoming Green River PCB concentration of 42 µg/kg. Modifying the incoming Green River concentration may change the start and end concentrations over 40 years, but it will not change how slowly the concentration decreases due to regular mixing of sediments from propwash. These site characteristics will ensure that surface sediment PCB concentrations remain elevated above incoming Green River concentrations for the foreseeable future. Therefore, the EW site will not equilibrate to incoming Green River sediment concentrations in any reasonable time frame.

Sediment Inputs to the East Waterway

EPA stated that the influence of sediments from the LDW are *de minimis*, or less than 1%. As stated in the FS, the Green River accounts for 99% of the sediment mass entering the EW, 0.7% is from the LDW bed sediments and lateral inputs, and 0.3% is from the EW lateral inputs (FS Section 5.1). However, the contributions from the LDW and urban runoff are not insignificant. The FS estimated incoming sediments from the Green River to be 42 µg/kg for total PCBs, but when accounting for these other diffuse urban inputs, the estimated average incoming concentration rises to 45.7 µg/kg for total PCBs (FS Table 5-5). The FS modeling accounts for reductions in EW lateral input solids and/or concentrations, which results in an estimated average incoming concentration of 44.9 µg/kg for total PCBs. The contribution of diffuse lateral inputs contributing to the incoming solids into the EW increases the concentration 9%, which is not *de minimis* and cannot be ignored.

The FS also acknowledged that the incoming sediments from the Green River that enter the EW are finer-grained than the Green River incoming sediments entering the LDW. Section 3 of FS Appendix B Part 3B states that silt- and clay-sized suspended solids are estimated to be 67% of the sediment entering the LDW but 99% of the sediment entering the EW. This led to a decision in the FS to use higher incoming Green River sediment concentrations that enter the EW compared to what enters the LDW site.

Several additional studies have been conducted to estimate Green River incoming sediments that were not completed during the FS and therefore could not be considered in the Green River concentration estimates in the FS. These studies were recently evaluated and summarized in the *LDW Pre-Design Studies Data Evaluation Report* (Windward 2020) to provide estimates of new incoming sediment concentrations for the LDW. These studies include the following:

- Filtered solids collected upstream at River Mile (RM) 10.4 next to Foster Links Golf Course by King County (2013 to 2015) (King County 2016)
- Solids collected in sediment traps upstream at RM 10.4 next to Foster Links Golf Course by King County (2013 to 2015) (King County 2016)
- Centrifuged solids collected upstream at RM 10.4 next to Foster Links Golf Course by the U.S. Geological Survey (USGS) (2013, 2015, and 2017) (Conn and Black 2014; Conn et. al. 2015, 2018)
- Fine-grained (<62.5 micrometer) bedded sediments collected upstream at RM 10.4 along Foster Links Golf Course by USGS (2013 to 2015) (Conn and Black 2014; Conn et. al. 2015, 2018)
- Sediment core data collected at the Turning Basin (RM 4.3 to RM 4.75) by USACE (2011 and 2017) (USACE 2011, 2018)

These datasets represent significant efforts conducted over the past several years. Collectively, they provide substantial evidence of the contaminant concentrations in Green River solids. These datasets have been compiled in Appendix F of the *LDW Pre-Design Studies Data Evaluation Report* (Windward 2020) and in the LDW Technical Memorandum: Compilation of Existing Data (Windward and Integral 2018), which can be found in the LDW Group's online project library. We believe these data provide sufficient information to estimate Green River solids concentrations as a contributor to establishing an EW anthropogenic background concentration, and no further Green River data collection is necessary. Similarly, incoming concentrations from EW lateral inputs have been summarized in the SRI, and additional data have been collected since the SRI, all of which could be used to establish anthropogenic background without further data collection.

Use of Feasibility Study Modeling to Support Anthropogenic Background

EPA stated that the FS modeling was developed to evaluate remedial alternatives. Thus, they felt this was a different objective than modeling that would be conducted to determine anthropogenic background. However, the FS model approach and methods needed to compare alternatives are exactly the same as those that would be needed to develop anthropogenic background concentrations. The same box model can be used; only the input decisions would need to be modified. Development of background concentrations was not stated as a modeling objective in the FS, but that does not mean the model is not relevant for the development of background concentrations. In order to determine an appropriate concentration to which the EW will equilibrate in the future, modeling will be needed to address how the various inputs contribute to surface sediments over time. This is exactly what the FS model was developed to do, and thus it can be used as a basis for determining appropriate anthropogenic background estimates.

References

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